THE FEASIBILITY OF USING AQUIFER STORAGE AND RECOVERY TO MANAGE WATER SUPPLIES IN GEORGIA

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Abstract. In Georgia, growing concerns about water scarcity have increased interest in policies and technologies to conserve, manage, and enhance water supplies. This paper focuses on the potential use of aquifer storage and recovery (ASR) to manage and enhance water supplies, particularly in the Flint River Basin where water scarcity is a substantial management concern. Our ASR research included an analysis of both economic and technical feasibility. From an economic perspective, we considered the feasibility of using ASR technology to offset new water uses in the Flint Basin. Our preliminary findings suggest considerable promise for this technology to serve as a means for enhancing water supplies for new municipal and industrial (M&I) uses in the Flint River Basin. The results were less promising in strict economic terms for the feasibility of using ASR to offset new agricultural water use.

The results of our technical feasibility analysis were promising. In the Flint Basin, ASR could potentially be used to store large volumes of surface water during the rainy season when surface water discharge rates are high or water from the Floridan aquifer when aquifer levels are highest. Stored water could be recovered when drought conditions exist in order to mitigate the effects of pumping from the river and interconnected Floridan aquifer system. Our analysis was of an ASR system that could provide for seasonal storage of approximately 1.5 billion gallons of water to help mitigate drought impacts. However, development of ASR facilities on even a larger scale might ultimately be feasible. The results of this analysis suggest that ASR could be used to support economic development in the region without new drought season withdrawals from the aquifer or surface water.

Shunned in Georgia until now ASR deserves serious consideration by policy makers, government officials, economic development concerns and the concerned public.

INTRODUCTION

With water scarcity during drought now a reality in Georgia (note the retirement of irrigated acreage in 2000 and 2001) the time has come to give serious consideration to innovative ways to augment water supplies. This paper explores the use of Aquifer Storage and Recovery (ASR) as one of those ways.

ASR is being turned to increasingly in neighboring states (both Florida and South Carolina have a numerous ASR systems in operation) and Georgia should avail herself to this proven method of water capture and storage. While there are likely many areas of the state suitable for the development of ASR this paper deals only with the Flint River Basin and in particular the area around Albany. Here the Clayton Formation has been over drafted and is currently under a moratorium to new users, providing an excellent receptacle. While the Flint River and Floridan aquifer both can offer excess water for capture.

In the Flint River Basin, water scarcity concerns create a real possibility that the Georgia Environmental Protection Division (EPD) may cap the number of water use permits (and associated levels of water use) in the Basin at existing levels. The region is faced with a problem: how can water be made available to accommodate new, future opportunities for population and economic growth? This paper looks at ASR for an answer.

CONCEPT

Albany is located on the banks of the Flint River on the Dougherty Plain. It is underlain by a series of sedimentary geologic formations many of which are excellent aquifers. The plan is to store treated water from the Flint River, or an interconnected water source (Floridan), in one of those deep artesian aquifers during periods of high flow. The stored water would be recovered during drought periods in order to augment existing flow in the basin. The target aquifer for water storage is the Paleocene age Clayton aquifer, which ranges in depth from approximately 625 to 750 feet below land surface (bls) in the project area.

The basic concept of utilizing ASR to augment supply is that, during drought years, communities experiencing economic and population growth may have water use permits that are inadequate to supply the water required to facilitate such growth, and given current conditions in the Flint River Basin, may be unable to obtain additional permits. The ASR facility would permit community groups to negotiate with the State's Environmental Protection Division for new water use permits based on the condition that, during drought years, the community's water use during the critical period April through September (or any other span of time) would be offset by equivalent discharges to the river provided by water stored with the ASR facility. With planned storage of 1.5 billion gallons annually, a 10 mgd facility could provide offset flows for one or more consecutive drought years, depending on the community's source of water, and if groundwater, the impact of pumping on river flows – and empirical questions that would have to become a part of any negotiations.

ECONOMIC FEASIBILITY

Much of Georgia is still in the enviable position of having access to "free" raw water for municipal, industrial and agricultural uses. Why then would a city or region invest millions in a water storage project? The simple answer is to prepare. In the event that new uses in the Flint basin are capped at existing levels, growth and economic opportunities are lost or at least will require sacrifices from existing users. By investing in an ASR project to store water to provide for future demands the investors can control their future and expand their opportunities. Therefore the economic feasibility of the project depends more on the desires of the local population and less on the per gallon cost of the water stored. For example; an ASR project costs $25 million but its existence allows an industry to expand or locate in the area creating hundreds of jobs, would it be economically feasible? When viewed as a job growth mechanism rather than water storage facility ASR can be not only economically feasible but a bargain.

HOW TO PROCEED

Communities in Southwest Georgia could use ASR technology in a number of ways to provide water supplies for new industry and economic growth. Given uncertainty about the amount of time required to accomplish appropriate tests and trial cycles of an ASR system before it could be put into use, if interest in pursuing ASR exists, it would be prudent to begin to develop some level of ASR capacity so that it would be available to communities if and when economic opportunities arise which require access to new water use permits. ASR potentially offers local governments in the region the opportunity to take their "water future" *into their own hands* — to manage water in the way that they believe best serves the region's interests. To this end, we suggest one of many *possible* approaches that might serve this purpose: a regional ASR authority. Our intention is not to advocate this or any other approach. Our intention is simply to set out an alternative that water managers in Southwest Georgia might take as a point of departure in thinking through ways by which ASR technology might be used to avoid limitations on economic growth posed by water shortages during periods of drought.

A regional ASR authority would comprise officials from counties and/or communities in the basin that choose to participate. The initial charge of the Authority would be the following:

1. The Authority would negotiate an agreement with the EPD wherein the EPD agrees to issue new water use permits to new business/industry wishing to locate within the Authority's jurisdiction under the condition that the Authority will offset, during periods of drought, any new water use associated with these permits from ASR storage. An important aspect of these negotiations would be a definition of conditions constituting "drought conditions" during which offsets would be required.

2. If a period of drought occurs during the interim period between the initiation of any newly permitted water use and the initiation of operation *of an EPD-approved* ASR storage facility, the Authority would agree to offset the new water use through the lease of agricultural water use from farmers qualified to participate in the Flint River Drought Protection auction. It would be prudent for the Authority to negotiate "futures" leasing arrangements with farmers in the area.

3. The Authority would acquire land in appropriate areas and conduct initial testing required by the EPD for approval of an ASR site. Such testing might include the design of the required water treatment plant (approved by the EPD) as well as any other system elements. Investment for the actual construction of any treatment plants as well as the development of production wells could be deferred until the need for offset water becomes a reality. Thus, plans for the ASR system are in place and approved by the EPD. It may or may not be desirable to put the full scaled wells and/or treatment plants in place prior to their need. One of the advantages of ASR is that discharge capacity can be built in relatively small increments. ASR well systems with a capacity of around 5 mgd (involving 2 to 3 production wells) are common in Florida. This capacity is more than sufficient to satisfy all but the largest water using industries (e.g., paper mills). ASR well systems with much larger capacity are being used in the U.S. Capacity can be established based on the current size of a developed system or by sequentially adding smaller-scaled wells as demand for water increases. With relatively small-scaled ASR systems (i.e., on the order of 5 mgd with a treatment plant with a capacity of 10 mgd, which could serve a well system with a 50 mgd capacity) the system can be expanded by the addition of new wells and, perhaps, treatment capacity, only as the need for such expansion arises. Given a regional authority that is pursuing the establishment of an ASR system, communities in the Flint River Basin can advertise to the business commu-

nity: Locate in the Flint River Basin -- we have more than ample water supplies to fill your needs. The costs of taking the steps described above to develop a regional authority and be prepared for possible future economic opportunities should be nominal. One would expect that these costs would certainly be small relative to the potential gain for the region.

CONCLUSIONS

Water scarcity (dry surface streams) is a reality during times of drought in Southwest Georgia. During the drought years of 2000 and 2001 the EPD paid farmers not to irrigate out of concern for flows in the Flint River. While we know of no plans to cap permitted withdrawals in the Flint basin at current levels the possibility exists.

Geologic and hydrologic conditions in the Albany area lend themselves to the development of an aquifer storage and recovery facility. Preliminary technical feasibility studies conducted by Water Resource Solutions, 428 Pine Island Road, S.W., Cape Coral, FL 33991 in association with HydroSource Associates, Inc., 50 Winter Street, Ashland, NH 03217 supports this assertion.

The establishment of a Regional Authority that would manage the ASR system would provide a means by which, in the face of an EPD-imposed cap on new water use permits, the region can take its water future in its own hands. Growth, as it relates to access to water, would be locally controlled. Our findings should, at a minimum, serve to stimulate discussion by local governments in Southwest Georgia about the possibility of establishing an ASR arrangement as suggested here. In the end, an assessment of the viability of the ASR technology must be made by a Regional Authority whose decisions are guided not only by direct system costs, but also by consideration of the benefits of creating regional capacity to accommodate the water needs of new industry and business. In this regard, consideration of issues including job creation and impacts on local tax bases will be of primary importance.

Finally, economic considerations aside, the author would like to offer the following for the reader's consideration. In 1881 Colonel John Porter Fort completed the first flowing artesian well in Georgia on his plantation about 20 miles west of Albany. The water came from the Clayton Formation. Following this success the City of Albany decided to avail itself to this resource and contracted to have a Clayton well drilled in the City. That well was completed in 1882 and the water flowed freely. Others soon followed and Albany became known as "The Artesian City". The literature seems to indicate that some wells continued to flow until the early 1940's. But by 1978 rapid growth and increased demand on local water resources had resulted in water levels in the Clayton to decline by as much as 135 feet. In 1992 the EPD imposed a permanent moratorium on new withdrawals from the Clayton. So 111 years after its discovery we had over drafted the Clayton to the point of placing it off limits to new users. Who can predict what condition the aquifer will be in 2117? Investing in the ASR project outlined here could potentially find it returned to predevelopment conditions.

LITERATURE CITED

Arthur, J.D., Cowart J.B., and Dabous, A., 2001, Florida aquifer storage and recovery geochemical study: year three progress report: Florida Geological Survey Open File Report 83, 48 pg.

Clarke, J.S., Faye, R.E., and Brooks, R., 1984, Hydrogeology of the Clayton Aquifer of Southwest Georgia: Georgia DNR Hydrologic Atlas 13.

Georgia EPD, 2006, Flint River Basin Regional Water Development and Conservation Plan: Georgia DNR Publication, 242 pg.

Georgia Geological Survey, 2001, Assessment of environmental effects associated with potential aquifer storage and recovery projects in coastal Georgia: Project Report 44, 39 pg.

Gorday, L. L., Lineback, J. A., Long, A. F., and McLemore, W. H., 1997, A Digital Model Approach to Water-Supply Management of the Claiborne, Clayton, and Providence Aquifers in Southwestern Georgia: Georgia DNR Bulletin 118.

Herrick, S. M., 1961, Well Logs of the Coastal Plain of Georgia: Georgia Geological Survey Bulletin Number 70.

Hicks, D. W., Krause, R. E., and Clarke, J. S., 1981, Geohydrology of the Albany Area: GA DNR Information Circular 57.

McFadden, S. S., and Perriello, D. P., 1983, Hydrogeology of the Clayton and Claiborne Aquifers in Southwestern Georgia: Georgia DNR Information Circular 55, 59 pg.

Torak, L.J., and McDowell, R.J., 1996, Ground-water resources of the Lower Apalachicola,

Chattahoochee-Flint River Basin in parts of Alabama, Florida, and Georgia-Subarea 4 of the Apa la- chicola-Chattahoochee-Flint and Alabama-Coosa-Tallapoosa River Basins: U.S. Geological Survey Open File Report 95-321,145 pg.

Wilson, D., and Cummings, R., 2005, Enhancing water supplies in the Flint River Basin: A preliminary exploration of the ASR Alternative: Georgia Water Planning and Policy Center, Water Policy Working Paper #2005-004, 16 pg.